

ATTORNEY DOCKET NO.
004578.1073

PATENT APPLICATION
09/660,733

3

IN THE CLAIMS

Applicants are amending the claims so that, after amendment, they will read as set forth in the clean version of the claims which appears below. For the convenience of the Examiner, all of the pending claims are set forth below, whether amended or not. Enclosed with this amendment is a marked-up version of the claims which have been changed, showing in bold type the changes that have been made by this amendment.

1. (Amended) An apparatus, comprising:

a thermally conductive part having a fluid passageway formed therein; and

turbulence inducing structure disposed along said passageway in a manner selected to achieve, in response to fluid flow through said fluid passageway, a predetermined temperature profile along said passageway in said thermally conductive part adjacent to said fluid passageway.

2. An apparatus according to Claim 1, wherein said structure includes protrusions extending from a surface of said fluid passageway toward a longitudinal, central axis of said fluid passageway.

3. (Amended) An apparatus according to Claim 1, wherein said structure includes first and second protrusions extending inwardly into said passageway from a surface of said passageway, said first protrusion being generally opposite said second protrusion along a perimeter of said passageway in

ATTORNEY DOCKET NO.
004578.1073

PATENT APPLICATION
09/660,733

4

a plane approximately perpendicular to a longitudinal axis of said passageway.

4. (Twice Amended) An apparatus according to Claim 1, wherein said structure includes an inwardly projecting annular protrusion formed along a perimeter of said passageway in a plane generally perpendicular to a longitudinal axis of said passageway.

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5. (Amended) An apparatus according to Claim 1, wherein said structure includes a plurality of portions which each induce turbulence, wherein each said portion is longitudinally spaced along said passageway by a respective longitudinal distance from every other said portion which is adjacent thereto, and wherein the lengths of said longitudinal distances vary along said passageway.

6. (Amended) An apparatus according to Claim 1, wherein said structure includes a plurality of portions which each induce turbulence, wherein each said portion is longitudinally spaced along said passageway by a respective longitudinal distance from every other said portion which is adjacent thereto, wherein said fluid passageway includes a first section and a second section which are separate and which each include at least two of said portions, and wherein said longitudinal distances between said portions in said first section are greater than said longitudinal distances between said portions in said second section.

7. An apparatus according to Claim 1, wherein said part includes a cold plate.

ATTORNEY DOCKET NO.
004578.1073

PATENT APPLICATION
09/660,733

5

8. (Amended) An apparatus according to Claim 7, wherein said cold plate is made of a material which includes aluminum silicon carbide (AlSiC).

9. An apparatus according to Claim 7, wherein said part includes tubing at least partially embedded within said cold plate, said tubing having a generally oval cross section, and wherein said passageway extends through said tubing.

10. (Amended) An apparatus according to Claim 9, wherein said tubing is made of a material which includes stainless steel.

11. (Amended) An apparatus according to Claim 9, wherein said structure includes crimps formed in said tubing, said crimps extending radially toward a longitudinal, central axis of said passageway.

12. An apparatus according to Claim 9, wherein said structure includes dimples formed upon said tubing, said dimples extending toward a longitudinal axis of said passageway.

13. An apparatus according to Claim 9, further comprising a fluid supply device in fluid communication with said passageway for causing a thermally conductive fluid to flow through said passageway.

ATTORNEY DOCKET NO.
004578.1073

PATENT APPLICATION
09/660,733

6

14. An apparatus according to Claim 13, further comprising a plurality of electronic components thermally coupled with said part, said components generating heat which is transferred to said fluid through said part.

15. (Amended) An apparatus according to Claim 14, further comprising a phased array antenna system, wherein said part, said structure, and said electronic components are portions of said phased array antenna system.

16. (Amended) An apparatus according to Claim 14, wherein said temperature profile is generally isothermal.

17. (Twice Amended) An apparatus, comprising:
a thermally conductive flat plate having a fluid passageway formed therein; and

a plurality of turbulence inducing structures disposed along said fluid passageway, wherein locations of said structures are selected to achieve, in response to fluid flow through said fluid passageway, a predetermined temperature profile along said passageway in said plate adjacent to said fluid passageway.

18. (Twice Amended) An apparatus according to Claim 17, wherein each said structure is longitudinally spaced along said passageway by a respective longitudinal distance from every other said structure which is adjacent thereto, and wherein the lengths of said longitudinal distances vary along said passageway.

ATTORNEY DOCKET NO.
004578.1073

PATENT APPLICATION
09/660,733

7

20. (Amended) An apparatus according to Claim 17, wherein said structures each include an annular protrusion extending into said passageway.

21. An apparatus according to Claim 17, further comprising a plurality of electronic devices coupled with a first face of said plate.

22. (Amended) A method of maintaining a predetermined temperature profile along material of a thermally conductive part adjacent a fluid passageway formed within said part, comprising:

B2
providing turbulence inducing structure within said fluid passageway; and

selecting a configuration of said structure to achieve, in response to fluid flow through said fluid passageway, a predetermined temperature profile along said passageway in said part adjacent to said fluid passageway.

23. (Amended) A method according to Claim 22, further comprising:

configuring said structure to include a plurality of portions which each induce turbulence;

spacing each said portion longitudinally along said passageway by a respective longitudinal distance from every other said portion which is adjacent thereto; and

selecting locations of said portions such that said longitudinal distances vary along said passageway.